REMARKS

This application has been carefully reviewed in light of the Office Action dated March 30, 2005. Claims 1, 19 to 24, 26 to 28, 32 and 33 are in the application, of which Claim 1 is still the only independent claim. Reconsideration and further examination are respectfully requested.

The Applicants thank the Examiner and his Supervisor for the courtesies and thoughtful treatment during the interview conducted by telephone on March 18, 2005. During the interview, the Examiner agreed that the art applied in the final rejection dated July 7, 2004, did not show a signal read-out line to read a signal from an image pickup element and to reset the image pickup element, as set out in the Amendment After Final Rejection dated October 7, 2004. It was agreed to file a Request for Continued Examination (RCE) so as to obtain consideration of the amended claim language, and those actions were subsequently taken.

Turning to the merits of the Office Action dated March 30, 2005, all claims except claim 26 were rejected under 35 U.S.C. § 103(a) over Japan 11-151233 (Nonaka[1/]) in view of U.S. Patent 6,567,125 (Shimizu) and further in view of Japan 10-104766

[1/]For purposes of determining the technological content of Nonaka, this Amendment relies on the machine-assisted translation provided by the USPTO in its Office Action dated September 11, 2003, and on U.S. Published Application No. 2002/0050568, which is consistent with the position taken by the USPTO in prior Office Actions.

(Tamura[2]). Claim 26 was rejected under § 103 further in view of U.S. Patent 5,060,069 (Aoki) in view of U.S. Patent 4,675,747 (Hanma). Reconsideration and withdrawal of the rejections are respectfully requested.

The present invention concerns an image sensing apparatus comprising a radiation generating apparatus adapted to generate radiation, a sensor comprising a plurality of image pickup elements for converting radiation to electrical signals, a signal line adapted to read out electrical signals from the image pickup elements, and a preamplifier adapted to amplify the electrical signals. A first power source is adapted to set the signal line to a reference potential, and a second power source is adapted to supply electrical power to the preamplifier. According to one aspect of the invention, a control circuit is adapted to cause the first power source to set the signal line to the reference potential before the radiation generating apparatus irradiates radiation, and to cause the second power source to supply electrical power to the preamplifier afterwards. According to a second aspect of the invention, the control circuit is further adapted to determine whether both of the first and second power sources are stopped, or whether only the second power source is stopped, and it makes this determination after reading out the electrical signals from the image pickup elements.

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[2] For purposes of determining the technological content of Tamura, this Amendment relies on the English-language abstract provided by the Office Action dated March 30, 2005, and on the attached computer-generated translation which was obtained from the website of the Japanese Patent Office ("JPO"). Since the translation is computer-generated, and has not been reviewed by anyone conversant in both Japanese and English, it naturally contains numerous errors and omissions, and is clearly non-grammatical. Nevertheless, and in spite of these inaccuracies, it is felt that the translation is helpful for understanding the general nature of the technological content of Tamura.

By virtue of the foregoing features, it is possible to greatly reduce electrical power consumption and suppress heat generation as compared to the prior art. For example, the first power source sets the signal line to the reference potential before irradiation, whereas the second power source supplies electrical power to the preamplifier afterwards. Moreover, after reading out of electrical signals from the image pickup elements, a determination is made as to whether both of the first and second power sources are stopped, or whether only the second power source is stopped. Using this determination, further benefits in power saving and heat avoidance are possible.

The art applied against the claims is not seen to disclose or to suggest the foregoing arrangement, and in particular is not seen to disclose or to suggest the particular sequence of power source supply between a first power source that sets a signal line to a reference potential before irradiation, and a second power source which supplies electrical power to a preamplifier afterwards. Moreover, the art of record is not seen to disclose or suggest a control unit which, after read out of electrical signals from image pickup elements, determines whether both of first and second power sources are stopped, or whether only a second power source is stopped.

The Office Action takes the position that Shimizu discloses timing of supply of power to an amplifier, and that Tamura shows setting of a signal line to a reference potential. Even if these understanding of the references are correct, there is still nothing in Applicants' view which would have suggested the specific sequence of operations set out in the claims, wherein the first power source sets the signal line to a reference potential before irradiation and the second power source supplies electrical power to the

preamplifier afterward. Moreover, there is nothing in Applicants' view which would have suggested a determination made after read out of electrical signals from an image pickup apparatus as to whether both of first and second power sources are stopped, or whether only the second power source is stopped. Finally, there is nothing in Applicants' view which would have suggested the attendant benefits of such an arrangement.

It is therefore respectfully submitted that the claims herein are fully in condition for allowance, and such action is courteously solicited.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office by telephone at (714) 540-8700. All correspondence should be directed to our address given below.

Respectfully submitted,

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PATENT ABSTRACTS OF JAPAN

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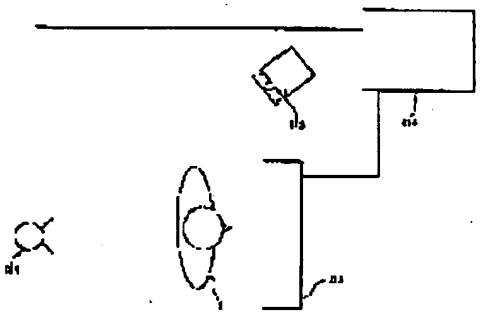
(54) RADIOGRAPHIC DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To enhance throughput or to reduce a wasteful using time by controlling the action of a radiographing part based on a detected result whether an object exists at an almost photographing position or not.
SOLUTION: The radiographing part 212 photographing the transmitted radiation of the object S is arranged in front of a radiation source 211 emitting radiation. An object detection part 213 detecting the existence of the object S at the almost photographing position of a solid image pickup element is arranged outside or inside the radiographing part 212. By a control part 214 controlling the radiographing part 212 and the radiation source 211, the radiographing part 212 is controlled based on the detected result of the detection part 213. Besides, this device is also provided with a mode as one of the driving modes of a system in addition to the mode of the whole device in which only an image pickup part is shifted to a standby mode when the object does not exist and it is shifted to a photographing mode when the object appears by detecting the object even in the case that the device is operated by a routine other than the image pickup routine by an operator.



LEGAL STATUS

[Date of request for examination]

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[Date of final disposal for application]

[Patent number]

[Date of registration]

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[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Radiography equipment characterized by having the photography means which photos a photographic subject with the radiation from a photographic subject, a detection means to detect the existence of the existence of the photographic subject in the outline camera station of this photography means, and the control means which controls actuation of said photography means based on detection of this detection means.
[Claim 2] Said radiation is radiography equipment according to claim 1 characterized by being an X-ray.
[Claim 3] It is radiography equipment according to claim 1 or 2 which said photography means has a conveyance means for conveying the record medium of the shape of a sheet which records an image as a latent image, and is characterized by said control means making said conveyance means convey said record medium to a position based on the detection result of said detection means.
[Claim 4] It is radiography equipment according to claim 3 which said detection means detects that a photographic subject exists, and is characterized by said conveyance means conveying said record medium to the photography ready position as said position.
[Claim 5] It is radiography equipment according to claim 3 which said detection means detects that a photographic subject does not exist, and is characterized by said conveyance means conveying said record medium to the photography position in readiness as said position.
[Claim 6] The record medium of the shape of said sheet is radiography equipment according to claim 3 characterized by being a film for filming.
[Claim 7] The record medium of the shape of said sheet is radiography equipment according to claim 3 characterized by being a fluorescent substance sheet for carrying out are recording record of the image information.
[Claim 8] Said photography means is a radiography component according to claim 2 characterized by having a solid state image sensor for carrying out a photographic subject image pick-up through the X-ray from a photographic subject, and controlling this solid state image sensor based on detection of said detection means.
[Claim 9] X-rays equipment characterized by to have the solid state image sensor which detects an X-ray, and the driving means which drives this solid state image sensor, and to have a detection means to detect the existence of the existence of the photographic subject in the outline camera station of said solid state image sensor, and the control means which changes said solid state image sensor and said driving means from transition or a standby mode to a standby mode based on detection of this detection means in the X-rays equipment which forms a digital image from the output of said solid state image sensor.
[Claim 10] Said standby mode is X-rays equipment according to claim 9 characterized by changing said driving means into a low-power condition.
[Claim 11] Said standby mode is X-rays equipment according to claim 9 or 10 characterized by maintaining all the terminals of said solid state image sensor to this potential.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the X-rays equipment of the configuration filmed through the X-ray from a photographic subject, the configuration which carries out are recording record of the image information through this X-ray at a fluorescent substance sheet, and carries out image reading with a reading means, or a configuration of carrying out direct detection of this X-ray with a solid state image sensor, and picturizing a photographic subject about radiography equipment.
[0002]
[Description of the Prior Art] In the use cycle of the conventional X-rays equipment, it usually becomes the power-source cycle of one diurnal rhythm. For example, while equipments, such as an X-ray film changer and an X-ray solid state camera, may also switch on a power source at the time of the operation test of an X-ray generator and a patient's etc. photographic subject may visit them after that at it, a power source maintains the condition of having been supplied and photography of the day intercepts a power source at the time of termination.
[0003] Since it is very rare to take a photograph in an X-ray with photography equipment continually in the meantime, while there is no photography, photography equipment usually shifts to the standby mode which reduces the load of an image pickup device by holding down to a low power or opening an image pickup device from an image pick-up condition. When there is no access between predetermined time to the case where it shifts to a standby mode by an operator's directions input, or photography equipment, photography equipment moves from this to a standby mode automatically.
[0004] And when a patient's etc. photographic subject appears, it usually shifts to the usual photography mode from the standby mode by an operator's directions input. Under the present circumstances, X-rays equipment makes photography preparations. The predetermined wait time amount for acquiring good image quality or its repeatability must be given only including a photography preparation period.
[0005]
[Problem(s) to be Solved by the Invention] As mentioned above, in order to return from a standby mode with directions of an operator, with conventional equipment, there is a problem which wait time amount produces after a return. On the contrary, although there is no body (photographic subject) -- an operator's failure and the set point of predetermined time are long -- equipment may be maintained in the state of photography preparation. This will sometimes contract the life of X-rays equipment. That is, with conventional equipment, the problem of generating of the latency time to photography and compaction of a total life cycle may arise.
[0006] This invention aims at offering radiography equipment equipped with the improvement in a throughput, or the **** function of a useless time.
[0007]
[Means for Solving the Problem] The 1st invention of this application for solving the above-mentioned problem is radiography equipment characterized by to have the photography means which photos a photographic subject with the radiation from a photographic subject, a detection means detect the existence of the existence of the photographic subject in the outline camera station of this photography means, and the control means which controls actuation of said photography means based on detection of this detection means.
[0008] Moreover, the 2nd invention is further characterized by said radiation being an X-ray.
[0009] Moreover, the 3rd invention has further a conveyance means for said photography means to convey the record medium of the shape of a sheet which records an image as a latent image, and said control means is characterized by making said conveyance means convey said record medium to a position based on the detection result of said detection means.
[0010] Moreover, the 4th invention detects further that, as for said detection means, a photographic subject exists, and said conveyance means is characterized by conveying said record medium to the photography ready position as said position.
[0011] Moreover, the 5th invention detects further that, as for said detection means, a photographic subject does not exist, and said conveyance means is characterized by conveying said record medium to the photography position in readiness as said position.
[0012] Moreover, the 6th invention is further characterized by the record medium of the shape of said sheet being a film for filming.
[0013] Moreover, the 7th invention is further characterized by the record medium of the shape of said sheet being a fluorescent substance sheet for carrying out are recording record of the image information.
[0014] Moreover, it is the radiography component according to claim 2 characterized by having a solid state image sensor for said photography means carrying out the photographic subject image pick-up of the 8th invention through the X-ray from a photographic subject further, and controlling this solid state image sensor based on detection of said detection means.
[0015] Moreover, the 9th invention of this application for solving the above-mentioned problem In the X-rays equipment which has the solid state image sensor which detects an X-ray, and the driving means which drives this solid state image sensor, and forms a digital image from the output of said solid state image sensor It is the X-rays equipment characterized by having a detection means to

detect the existence of the existence of the photographic subject in the outline camera station of said solid state image sensor, and the control means which changes said solid state image sensor and said driving means from transition or a standby mode to a standby mode based on detection of this detection means.
[0016] Moreover, the 10th invention is further characterized by said standby mode changing said driving means into a low-power condition.
[0017] Moreover, the 11th invention is further characterized by said standby mode maintaining all the terminals of said solid state image sensor to this potential.
[0018]
[Embodiment of the Invention] The example of this invention is explained at a detail based on drawing below.
[0019] Drawing 1 is the configuration schematic diagram of the radiography equipment of the 1st example of this invention.
[0020] The radiation image photography section 212 which photos the transparency radiation of a photographic subject S ahead of the radiation source 211 which generates a radiation is arranged, and the photographic subject detection section 213 which detects existence of a photographic subject S the exterior or inside the radiation image photography section 212 is arranged. 214 is a control section which controls the radiation image photography section 212 and the radiation source 211. A control section 214 controls the radiation image photography section 212 based on the detection result of the photographic subject detection section 213 to mention later. The detail of the photographic subject detection section 213 is explained in full detail behind.
[0021] Drawing 2 is the sectional view showing the internal configuration of the radiation image photography section 212 of the radiography equipment of the 1st example. The radiation image photography section 212 is a film changer for roentgenography, and, specifically, is held in the film changer case 200.
[0022] A vacuum pump and F of a roller pair for a receipt magazine for a supply magazine for a back lateral pressure plate and 205 to contain the film non-taken a photograph and 206 to contain the film taken a photograph, and 207. 208 and 209 to convey a film, the motor by which 210 becomes the driving source of a roller pair, and 215 are films the before side for 201 and 202 sticking a film to the before side intensifying screen and the backside intensifying screen, and sticking 203 and 204 between the order intensifying screens, respectively. The photographic subject detection section 213 which is not illustrated in this Fig. and the control section 214 which manages a mode of operation are allotted to the film changer case 200 interior by this example.
[0023] In the film changer case 200 interior, in case a photograph is taken, Film F is picked out from the supply magazine 205 which has contained the photography film by the non-illustrated tripper style one sheet. then, a motor 210 is driven -- making -- a roller pair -- after Film F is stuck on the backside intensifying screen 202 by 207, 208, and 209, it sends into the lateral pressure plate 204. And after not illustrating the back lateral pressure plate 204, it drives in the direction of an arrow head a with a lateral pressure plate drive, and it pushes against the front lateral pressure plate 203, and vacuum adhesion of the film F is further carried out between the order intensifying screens with a vacuum pump 215.
[0024] After it is stuck to Film F between the order intensifying screen 201 and 202 and it is in the condition which can be photoed, a radiation is irradiated from the radiation source 211 by actuation of an operator, and the radiation image of the radiation which penetrated the photographic subject is photoed.
[0025] The time amount taken to pick out Film F from the supply magazine 205 mentioned above, and to complete photography preparation is about 10 seconds, and after a photographic subject S settles in a camera station, in having started feed, an operator and the latency time of a photographic subject S become long. In this example, when the photographic subject detection section 213 shown in drawing 1 detects a photographic subject S, a control section 214 starts feed for Film F from the supply magazine 205 automatically, and is shortening the time amount to a photography preparation completion.
[0026] moreover, the control section 214 to which it was notified from the photographic subject detection section 213 that there is no photographic subject when conversely left with a photography preparatory state, i.e., the condition of having fed with the film, -- a photography preparatory state -- canceling -- the adhesion between the order intensifying screen 201 and 202 -- solving -- a roller pair -- backward feed [207, 208, and 209 / Film F / the supply magazine 205]. Thereby, from the case where vacuum adhesion is performed continuously, the consumed electric current can be decreased and consumption of a vacuum pump or others can be oppressed.
[0027] The photographic subject detection section 213 is described concretely.
[0028] The schematic diagram of an example of the photographic subject detection section 213 is shown in drawing 3 . In drawing 3 , the photographic subject detection section 213 is the detection sensor of a floodlighting mold, and consists of light emitting devices 51, such as LED and LD, and photo detectors 52, such as PSD and two or more photodiodes.
[0029] The light (here infrared light) irradiated from the light emitting device 51 is collimated by the lens, and forms a quite acute beam. When reflective objects, such as the body, exist on this beam, after condensing that reflected light with a lens, light is received by the photo detector 52. It outputs that the photo detector detected the light-receiving location, counted the include angle of return light backward with the non-illustrated computing element, and detected the body in more than a predetermined include angle. For example, in the case of this example, when a photographic subject S goes into less than 1m of the photography side of the film changer case 200, it has set up so that a photographic subject S may be detected for the first time.
[0030] In addition, the combination of a light emitting device and CdS, pyroelectric infrared detectors, etc., such as LED, may only be used as the photographic subject detection section 213 using light.
[0031] The schematic diagram of other examples of the photographic subject detection section 213 is shown in drawing 4 . In drawing 4 , the photographic subject detection section 213 is a configuration measured using a supersonic wave, detects reflection by the body of the supersonic wave from an ultrasonic generator 61 with the ultrasonic receiver 62, and detects existence of the body.
[0032] The schematic diagram of an example of further others of the photographic subject detection section 213 is shown in drawing 5 . drawing 5 -- if it is, the photographic subject detection section 213 uses the touch sensor 71 which detects a photographic subject S by sensing contact of the body.
[0033] Drawing 6 is the sectional view showing the internal configuration of the 2nd example which transposed the radiation image

photography section 212 of the radiography equipment of the 1st example to the equipment which used the photostimulable phosphor sheet.

[0034] The radiation image photography section 212 specifically carries out are-recording record of the radiation image information at a photostimulable phosphor sheet, and excitation light is irradiated at this, and the light which carries out accelerated-phosphorescence luminescence according to the image information by which are recording record was carried out is detected, and image information is read, and it is radiation image-information write-reading equipment which changes into an electrical signal and is reproduced, and holds with the photographic subject detection section 213 and a control section 214 in the radiation image information write-reading equipment case 300.

[0035] The photostimulable phosphor sheet P is conveyed by the conveyance device constituted with the motor 303 used as a driving source, and the endless belts 304, 305, 306, and 307 connected by the communicative functions (for example, a chain, a gear, etc.) which are not illustrated [which are driven by this motor 303]. This motor 303 is controlled by the control section 214. 308 is a reader for reading the radiation image information by which are recording record was carried out on the photostimulable phosphor sheet P. In a reader 308, the laser beam from a laser light source 309 is irradiated at the photostimulable phosphor sheet P, and it reads in photoelectricity by receiving a strong accelerated-phosphorescence luminescence light according to the radiation image information of the photostimulable phosphor sheet P by the photograph mull 310. 311 is an elimination unit to which the residual energy of the photostimulable phosphor sheet P is made to emit. Here, the residual energy of the photostimulable phosphor sheet P is emitted by irradiating elimination light from the elimination light sources 312, such as a fluorescent light, at the photostimulable phosphor sheet P.

[0036] When the non-illustrated photographic subject detection section 213 detects existence of a photographic subject, according to delivery and it, a control section 214 drives a motor 303 for a detection result to a control section 214, and the photostimulable phosphor sheet P non-taken a photograph is arranged to the camera station shown in drawing. Moreover, a control section 214 makes the preparations which work the elimination unit 311 to a reader 308. Specifically it energizes to a laser light source 309 or the elimination light source 312, an exposure is prepared, it reads automatically, and elimination preparations are made. On the other hand, when a photographic subject does not exist, energization is decreased to the radiation image detecting element 213 of a laser light source 309 or elimination light source 312 grade. Thereby, the consumed electric current of these light sources can be decreased, and consumption is oppressed and the thing of it can be carried out.

[0037] The 3rd example of this invention using the photodetector array as the radiation image photography section 212 is described using drawing 7 or subsequent ones.

[0038] Drawing 7 is the X-ray image pick-up structure-of-a-system explanatory view of the 3rd example. The X-ray image pick-up system of this example is explained using drawing 7. In 101, an X-ray room and 102 express X-ray control room, and 103 expresses the diagnostic room. Overall actuation of this X-ray image pick-up system is governed by the system control section 110. The function of the system control section 110 is mainly described below.

[0039] First, the directions from an operator are received through the operator interface 111.

[0040] The operator interface 111 has the touch panel on a display, a mouse, a keyboard, a joy stick, a foot switch, etc. The contents of directions are ******, such as an art of image pick-up conditions (a still picture, an animation, voltage of X-ray tube, tube electric current, X-ray irradiation time amount, etc.) and image pick-up timing, image-processing conditions, Subject ID, and a taking-in image.

[0041] And the system control section 110 directs the image pick-up conditions based on directions of the image pick-up person 105 to the image pick-up control section 214 which manages an X-ray image pick-up sequence, and incorporates data. Based on the directions, X-ray generator 120 which is the radiation source 211, the berth 130 for an image pick-up, and X-ray detector 140 are driven, image data is incorporated, after transmitting to the image-processing section 10, the image pick-up control section 214 performs the image processing specified by an operator, and it saves at a display at a display 160, and it saves basic image-processing data at external storage 161 at coincidence.

[0042] Furthermore, based on directions of the image pick-up person 105, the system control section 110 transmits image data to the equipment on a re-image processing and a playback display, and a network, and performs printing etc. to preservation, a display display, or a film.

[0043] Next, sequential explanation is added for the flow of a signal later on.

[0044] X-ray tube 121 and the X-ray diaphragm 123 are included in X-ray generator 120. X-ray tube 121 is driven according to the high-pressure generating power source 124 controlled by the image pick-up control section 214, and emits X-ray beam 125. The X-ray diaphragm 123 is driven by the image pick-up control section 214, and with modification of an image pick-up field, X-ray beam 125 is orthopedically operated so that unnecessary X-ray irradiation may not be performed. It turns to the analyte 126 which lay on the roentgenoparent berth 130 for an image pick-up, and X-ray beam 125 is ********. The berth 130 for an image pick-up is driven based on directions of the image pick-up control section 214. After X-ray beam 125 penetrates analyte 126 and the berth 130 for an image pick-up, it is irradiated by X-ray detector 140.

[0045] The X-ray detecting element 140 consists of a grid 141, a scintillator 142, a photodetector array 8, an X-ray light exposure monitor 144, and a drive circuit 145. A grid 141 reduces the effect of the X-ray scattering produced by penetrating analyte 126. A grid 141 consists of an X-ray low absorption member and a high absorption member, for example, is having stripe geometry of aluminum and Pb. And at the time of X-ray irradiation, a grid 141 is vibrated based on directions of the image pick-up control section 214 so that moire may not arise with the relation of the grid ratio of the photodetector array 8 and a shot 141.

[0046] In a scintillator 142, the parent matter of a fluorescent substance is excited by the high X-ray of energy, and the fluorescence of a visible region is acquired by the recombination energy at the time of recombining. The fluorescence has some which are depended on the emission center matter activated in parents, such as a thing, CsI:Tl, ZnS:Ag, etc. which are depended on the parent itself, such as CaWo4 and CdWO4.

[0047] This scintillator 142 is adjoined and the photodetector array 8 is arranged. This photodetector array 8 changes a photon into an

electrical signal. The X-ray light exposure monitor 144 supervises the amount of radioparency. The X-ray light exposure monitor 144 may detect a direct X-ray using the photo detector of crystal silicon etc., and may detect the light from a scintillator 142. In this example, the light (it is proportional to X dosage) which penetrated the photodetector array 8 is detected by the amorphous silicon photo detector formed by the photodetector array 8 substrate rear face, delivery and the image pick-up control section 214 drive the high-pressure generating power source 124 for that information based on that information to the image pick-up control section 214, and an X-ray is intercepted or adjusted to it. Under control of the image pick-up control section 214, the drive circuit 145 drives the photodetector array 8, and reads a signal from each pixel. The photodetector array 8, the circumference drive circuit 145, and the photographic subject detection section 213 are explained in full detail later.

[0048] The picture signal from the X-ray detecting element 140 is transmitted to the image-processing section 10 in the X-ray control room 102 from the X-ray room 101. Since the inside of the X-ray room 101 has the large noise accompanying X-ray generating in the case of this transfer and image data may not be transmitted correctly because of a noise, it is necessary to make noise-proof nature of a transfer way high. It is desirable to use the transfer way by to make it the transmission system which gave the error correction function, the twisted wire pair with shielding according to a differential driver in addition to this, or the optical fiber. In the image-processing section 10, an indicative data is changed based on directions of the image pick-up control section 214 (it states in detail later). In addition, it is also possible to perform amendment of image data, spatial filtering, recursive call processing, etc. on real time, or to perform gradation processing, scattered-radiation amendment, DR compression processing, etc.

[0049] The processed image is displayed on a display 160 through a display adapter 151. Moreover, the basic image with which only amendment of data was performed to a real-time image processing and coincidence is saved at high-speed memory 161. As a high speed storage 161, the data storage equipment which fulfills large capacity, a high speed, and high-reliability is desirable, for example, hard disk arrays, such as RAID, etc. are desirable. Moreover, based on directions of an operator, the image data stored in the high speed storage 161 is saved at external storage. After being reconfigurated so that image data may fulfill predetermined specification (for example, IS&C) in that case, it is saved at external storage. External storage is a hard disk for example, in a magneto-optic disk 162 and the file server 170 on LAN etc.

[0050] Through the LAN board 163, this X-ray image pick-up system is possible also for connecting with LAN, and has structure with the compatibility of data with HIS. The monitor 174 which displays an animation and a still picture for an image, the file server 170 which files image data, the image printer 172 which outputs an image to a film, a complicated image processing, the terminal 173 for image processings which offers diagnostic exchange, etc. are connected to LAN not to mention connecting two or more X-ray image pick-up systems. This X-ray image pick-up system outputs image data according to a predetermined protocol (for example, DICOM). In addition, the real-time telediagnosis according to a medical practitioner using the monitor connected to LAN is possible at the time of an X-ray image pick-up.

[0051] The equal circuit of an example of the photodetection array 8 is shown in drawing 8 . Although the following examples add explanation about the two-dimensional amorphous silicon sensor, even if it is not necessary to limit especially a sensing element for example, and they are other solid state image sensors (charge-coupled device etc.) or a component like a photo multiplier, it is the same about the function of the A/D-conversion section, and a configuration.

[0052] Now, it returns to drawing 8 and explanation is added. One configuration consists of switching TFT22 which controls are recording and reading of the photodetection section 21 and a charge, and is formed by the amorphous silicon (alpha-Si) generally allotted on the substrate of glass. In this example, optical diode with parasitism capacitance is only sufficient as 21-C in the photodetection section 21, and it may catch with the photodetector which contains additional capacitor 21-C in juxtaposition so that the dynamic range of optical diode 21-D and a detector may be improved. The anode A of diode 21-D is connected to the bias wiring Lb which is a common electrode, and Cathode K is connected to the switching TFT22 in which the control for reading the charge accumulated in capacitor 21-C is free. In this example, switching TFT22 is the thin film transistor connected between the cathode K of diode 21-D, and the amplifier 26 for charge read-out.

[0053] After switching TFT22 and a signal charge operate the switching element 25 for reset and reset capacitor 21-C, by emitting a radiation 1, they carry out charge generating according to a dosage by optical diode 21-D, and are accumulated in capacitor 21-C. Then, again, switching TFT22 and a signal charge operate the switching element 25 for reset, and transmit a charge to a capacitative element 713. And it reads with a preamp 26 by making into a potential signal the amount accumulated by optical diode 21-D, and an incidence dose is detected by performing A/D conversion.

[0054] Drawing 9 is a representative circuit schematic showing the photo-electric-conversion equipment arranged to two-dimensional. The photo-electric-conversion actuation at the time of extending concretely the optoelectric transducer shown by drawing 8 to two-dimensional, and constituting it is described.

[0055] The pixel of the photodetection array 8 consists of about 2000x2000 to 4000x4000 pixels, and array area is about 200mmx200mm-500mmx500mm. In drawing 9 , the photodetection array 8 consists of pixels of 4096x4096, and array area is 430mmx430mm. Therefore, the size of 1 pixel is about 105x105 micrometers. The longitudinal direction was wired in 4096 pixels of 1 block, and each pixel is arranged two-dimensional by arranging 4096 lines perpendicularly in order.

[0056] Although the example which constituted the 4096x4096-pixel photodetector array 8 from an above-mentioned example with one substrate was shown, the 4096x4096-pixel photodetector array 8 can also consist of photodetectors with 2048x2048 pixels of four sheets. There is a merit of the yield improving by dividing and manufacturing 2048x2048 detectors, when it constitutes one photodetector array 8 from four sheets.

[0057] 1 pixel consists of an optoelectric transducer 21 and switching TFT22 as above-mentioned. 21-(1 1) - 21-(4096 4096) corresponds to the above-mentioned optoelectric transducer 21, and expresses the K and anode side for the cathode side of photodetection diode as A. 22-(1 1) - 22-(4096 4096) corresponds to switching TFT22.

[0058] K electrode of optoelectric-transducer 21-(m, n) of each train of the two-dimensional photodetector array 8 is connected to the common train signal line (Lc 1-4096) to the train by the corresponding source of switching TFT22-(m, n), and the drain track. For example, optoelectric-transducer 21-(1 1) - (1 4096) of a train 1 is connected to the 1st multiple-message-transmission number wiring

Lc1. A electrode of the optoelectric transducer 21 of each line is connected to the bias power supply 31 which operates the above-mentioned mode through the bias wiring Lb in common. The gate electrode of TFT22 of each line is connected to line selection wiring (Lr 1-4096). For example, - (4096 1) is connected to TFT22- (1 1) of a line 1, and the line selection wiring Lr1. The line selection wiring Lr is connected to the image pick-up control section 33 through the line selector section 32. The line selector section 32 consists of an address decoder 34 and 4096 switching devices 35. It is possible to read Rhine Lm of arbitration by this configuration. If the line selector section 32 is constituted most simply, it can also be constituted with the shift register only used for the liquid crystal display etc.

[0059] The multiple-message-transmission number wiring Lc is connected to the signal read-out section 36 controlled by the image pick-up control section 33. In a preamp for a switch for 25 to reset the multiple-message-transmission number wiring Lr to the reference potential of the reset reference supply 24 and 26 to amplify signal potential, and 38, a sample hold circuit and 39 express an analog multiplexer, and 40 expresses an A/D converter, respectively. The signal of each multiple-message-transmission number wiring Lm is amplified with a preamp 26, and is held by the sample hold circuit 38. The output is transmitted to the image-processing section 10 which i: is outputted one by one to A/D converter 40 by the analog multiplexer 39, is changed into digital value, and is not illustrated.

[0060] The photo-electric-conversion equipment of this example divides 4096x4096 pixels into 4096 Rhine Lcn, transmits the output of 4096 pixels per train to coincidence, and is outputted one by one to A/D converter 40 by the analog multiplexer 39 through preamp 26-1-4096 and sample hold section 38-1-4096 through this multiple-message-transmission number wiring Lc.

[0061] Although expressed with drawing 9 that A/D converter 40 consists of one, A/D conversion is performed to coincidence in the network of 4-32 In fact. This is because it is required that reading time amount of a picture signal should be shortened, without enlarging an analog signal band and an A/D-conversion rate superfluously. It mentions later for details about the A/D-conversion section.

[0062] If it has a relation with close storage time and A/D-conversion time amount and A/D conversion is performed at a high speed, it will become difficult for the band of an analog circuit to become large and to attain desired S/N. Therefore, it is required that reading time amount of a picture signal should be shortened, without making an A/D-conversion rate quick superfluously. For that purpose, although what is necessary is just to perform A/D conversion using many A/D converters 40, cost becomes high in that case. Therefore, it is necessary to choose a suitable value in consideration of an above-mentioned point.

[0063] Since the irradiation time of a radiation 1 is about ten to 500 msec, it is appropriate the order of 100msec(s) or to make the incorporation time amount or the charge storage time of a full screen a little short slightly.

[0064] For example, in order to carry out the sequential drive of all the pixels and to capture an image by 100msec(s), when an analog signal band is set to about 50MHz, for example, A/D conversion is performed with the sampling rate of 10MHz, also at the lowest, four A/D converters 40 are needed. This image pick-up equipment performs A/D conversion to coincidence by 16 lines. The output of 16 A/D converters 40 is inputted into 16 memory (FIFO etc.) corresponding to each which is not illustrated. It is transmitted to the future image-processing section 10 or its memory as image data which hits the scanning line of one line which continued by choosing and changing the memory. Then, it displays on displays, such as a display, as an image and a graph.

[0065] Now, the cycle of ON/OFF of the power source of X-ray image pick-up equipment usually turns into a power-source cycle of one diurnal rhythm. For example, while an X-ray solid state camera may also switch on a power source at the time of the operation test of an X-ray generator and a patient's etc. photographic subject may visit it after that at it, a power source maintains the condition of having been supplied and the image pick-up of the day intercepts a power source at the time of termination.

[0066] While the power source is switched on, it is very rare to picturize an X-ray with image pick-up equipment continually. if image pick-up equipment is maintained with an image pick-up condition while there is no image pick-up for a long period of time, measure and power consumption will become large. Furthermore, in this example, TFT22 on an amorphous silicon device has the phenomenon in which ON resistance at the time of a flow goes up with the increment in the operating time. If fastidious, it will usually appear as a fall of sensor sensibility. From these reasons, image pick-up equipment shifts X-ray image pick-up equipment to a standby mode, while there is no image pick-up, in order to reduce the load of an image pickup device by stopping a low power or opening an image pickup device from an image pick-up condition.

[0067] Drive Rhine Lc, Lr, and Lb of the photodetection array 8 is altogether arranged with this potential, for example, GND potential, and, specifically, potential is not applied to the photodetector array 8. Moreover, in addition to this, it is set as the surrounding line selector section 32, the signal read-out section 36, the condition that maintained the output about the image pick-up control-section 33 circumference circuit further, or the condition of not becoming a problem, and it is made low consumed-electric-current mode, and stands by.

[0068] Now, when a patient's etc. photographic subject appears, it usually shifts to the usual image pick-up mode from the standby mode with directions of an operator. Under the present circumstances, X-ray image pick-up equipment makes image pick-up preparations. The predetermined wait time amount for acquiring good image quality or its repeatability must be given only including an image pick-up preparation period. This is time amount until it settles down enough, in order that it may be the time amount which circumference driver elements, such as the line selector section 32 and the signal read-out section 36, fall and wear to a steady state, and waits for Lycium chinense or the property of the photo detector array 8 may acquire good image quality, for example, it serves as time amount until a dark current property settles down.

[0069] Next, transition of a mode of operation is described using drawing 10 and drawing 11 . It is a flow chart concerning [drawing 10 concerning a timing chart / drawing 11] body detection and mode transition. Hereafter, actuation is explained along with the flow chart of drawing 11 .

[0070] First, the return in photography mode from a standby mode is described.

[0071] In the example of drawing 10 , X-ray image pick-up equipment is a standby mode first. The drive control section has managed this, and it is detecting the photographic subject (patient) in the photographic subject detection section 213 at intervals of predetermined as it showed the photographic subject detection trigger signal 100 also at the time of this standby mode. In this

example, the detection result of A timing of the photographic subject detecting signal 101 serves as body detection. Since there is possibility of incorrect detection, re-detection is tried after predetermined time. If this result also serves as body detection, it will change in image pick-up mode. If it changes in image pick-up mode, the sensor drive 102 will be started. A sensor condition has an image pick-up preparation completion after the predetermined time, and this X-ray image pick-up equipment will be in an image pick-up condition.

[0072] Next, the transition to a standby mode from photography mode is described.

[0073] A photographic subject is no longer detected by the photographic subject detection section 213 to B timing among drawing 10. Since there is possibility of incorrect detection like the above also in this case, it detects in the photographic subject detection section 213 after predetermined time further. When a photographic subject is not detected too here, in this example, the part about the image pick-up of image pick-up equipment goes into a standby mode immediately. Of course, after the photographic subject stopped being immediately besides a setup stuck on a standby mode, and carrying out predetermined time progress, you may change to a standby mode.

[0074] About the photographic subject detection section 213, since it stated in the 1st example, it omits for details. In this example, although considered as the configuration which forms the photographic subject detection section 213 and a control section 214 in the exterior of the radiation detection means 212, naturally you may also incorporate inside the radiation detection means 212.

[0075] Moreover, making only an image pick-up part change to a standby mode, when a photographic subject is detected and a photographic subject is not apart from [in this example / when the operator is operating X-ray image pick-up equipment except an image pick-up routine (for example, also when performing image filing and an image-processing & display)] the mode of the whole X-ray image pick-up equipment, and changing in image pick-up mode, when a photographic subject appears conversely also has as one of the drive modes of a system.

[0076]

[Effect of the Invention] As mentioned above, according to the 1st invention, the radiography equipment which makes possible the improvement in a throughput or **** of a useless time is realized.

[0077] Moreover, according to the 2nd invention, still such effectiveness is realizable with the photography equipment which used the X-ray.

[0078] Moreover, according to the 3rd invention, according to the condition of a photographic subject, a record medium can be arranged appropriately, and the improvement in a throughput or **** of a useless time can be realized.

[0079] Moreover, according to the 4th invention, if a photographic subject comes to a camera station, it can arrange a record medium to a photography ready position automatically, it shortens the time amount to photography, and can improve a throughput.

[0080] Moreover, according to the 5th invention, if a photographic subject separates from a camera station, a record medium can be automatically arranged to a photography position in readiness, **** of the useless time of equipment can be realized, and improvement in the endurance as power saving and equipment can be realized.

[0081] Moreover, according to the 6th invention, according to the condition of a photographic subject, a film can be arranged appropriately, and the improvement in a throughput or **** of a useless time can be realized.

[0082] Moreover, according to the 7th invention, according to the condition of a photographic subject, a fluorescent substance sheet can be arranged appropriately, and the improvement in a throughput or **** of a useless time can be realized.

[0083] Moreover, according to the 8th invention, according to the condition of a photographic subject, a solid state image sensor can be controlled appropriately, and the improvement in a throughput or **** of a useless time can be realized.

[0084] Moreover, according to the 9th invention, improvement in a throughput is realized by making photography preparations by existence of a photographic subject in roentgenography, or when a photographic subject is not, by making actuation of photography equipment into a standby mode, **** of a useless time is made possible and improvement in power saving and the endurance as equipment is realized.

[0085] Moreover, according to the 10th invention, improvement in power saving and the endurance as equipment is realized by changing a driving means into a low-power condition.

[0086] Moreover, according to the 11th invention, the endurance of a component can be improved by maintaining all the terminals of a solid state image sensor to this potential.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The configuration schematic diagram of the radiography equipment of the 1st example
[Drawing 2] The sectional view showing the internal configuration of the radiation image photography section of the 1st example
[Drawing 3] The explanatory view of an example of a photographic subject detection means
[Drawing 4] The explanatory view of other examples of a photographic subject detection means
[Drawing 5] The explanatory view of other examples of a photographic subject detection means
[Drawing 6] The configuration explanatory view of the radiation image photography section of the 2nd example
[Drawing 7] The radiation image pick-up structure-of-a-system explanatory view of the 3rd example
[Drawing 8] Sensor representative circuit schematic
[Drawing 9] Drawing showing the example of a photodetector array configuration
[Drawing 10] The timing-chart Fig. about body detection and image pick-up equipment
[Drawing 11] The flow chart about the drive mode of body detection and image pick-up equipment
[Description of Notations]
1 Radiation
21 Sensing Element
26 Preamp
38 Sample Board Circuit
39 Analog Multiplexer
40 A/D-Conversion Section
41 Amplifier
42 A/D Converter
43 A/D-Conversion Output Selection Section
60 Amendment Control ****
61 Memory for Correction Factors
62 Amendment Operation Part
63 Picture Signal Amendment Section
211 Radiation Source
212 Radiation Image Photography Section
213 Photographic Subject Detection Section
214 Image Pick-up Control Section
303 Motor
304-307 Endless belt
308 Reader
309 Laser Light Source
310 Phot Mull
311 Elimination Unit
312 Fluorescent Light
P Photostimulable phosphor sheet
S Photographic subject

[Translation done.]